

Laparoscopic Diverticulocystoplasty for Low Compliance Bladder in a Child

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ABSTRACT

Low compliance bladder with a posterior urethral valve is a common association. Augmentation cystoplasty is one of the management options. We present the case report of a 4-y-old boy who presented with low compliance bladder, bladder diverticulum, right obstructive megaureter, and left grade IV reflux, 6 mo following PUV fulguration. He was managed by laparoscopic diverticulocystoplasty with right ureteric reimplantation and left detrusorrhaphy. The patient showed subjective and urodynamic improvement at 12 mo follow-up. The use of diverticulum for augmentation is advantageous, as it abides by the principle of bladder augmentation with urothelium. This is the first case report of successful use of diverticulum for laparoscopic bladder augmentation in a child.

Key Words: Low compliance bladder, Pediatric, Posterior urethral valve, Laparoscopy, Diverticulocystoplasty, Diverticulum.

INTRODUCTION

Varying degrees of bladder dysfunction and upper tract changes accompany posterior urethral valves. Detrusor overactivity, low compliance, and low capacity bladder can cause deterioration of the existing renal dysfunction and morphology. Loss of bladder compliance can be seen even following valve management in many patients.¹ Up to 50% of patients can have vesicoureteric reflux,² and a majority have dilated ureters due to the poorly compliant bladder or increased urinary output. Primary and secondary diverticula may be associated with a posterior urethral valve. Use of diverticula for augmentation of low compliance bladder has been described in adults.³

This article highlights the technique of laparoscopic diverticulocystoplasty in a child with a low compliance bladder, right obstructive megaureter, and left ureteric reflux secondary to PUV. Laparoscopic diverticulocystoplasty is a feasible, successful procedure and has all the advantages of laparoscopy. It may be a preferable option because urothelium is used.

CASE REPORT

A 4-y-old boy presented with a history of poor urinary stream and straining to void for 6 mo. He had a documented UTI 2 wk prior to presentation. He was afebrile, and a clinical examination was unremarkable at the time of the initial visit. Urine culture was sterile, and his blood urea and serum creatinine were normal (30mg/dL and 0.7mg/dL, respectively). Ultrasonogram revealed bilateral hydroureteronephrosis with ureters dilated up to the bladder. The bladder was thick walled (5mm), and there was a diverticulum on the right posterolateral wall of the bladder. Contrast CT urogram (**Figure 1**) confirmed the presence of a diverticulum arising from the right posterolateral wall of the bladder associated with bilateral hydroureteronephrosis. The right ureter was dilated till its lower end and was curving around the diverticulum and entering its neck. MCU showed left-sided grade IV vesico-ureteric reflux with dilated posterior urethra and a posterior urethral valve. Cystoscopy and antegrade fulguration of the posterior urethral valve was done. Anticholinergics were

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DOI: 10.4293/108680812X13462882736411

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started. The child had persistent storage lower urinary tract symptoms even after 6 mo following PUV fulguration. Urodynamic study showed a low compliance bladder (**Figure 2**). An isotope renogram showed a GFR of 22mL/min in the right kidney and 33.2mL/min in the left kidney. MRI of the spine did not show any anomalies. Hence, the plan was to augment the bladder and to reimplant the obstructed right ureter and the refluxing left ureter.

The child while under general anesthesia was placed in the supine position. Four ports were introduced: a 10-mm camera port 1cm above the umbilicus in the midline; two 5-mm ports 5cm below and lateral to the camera port, and

a 10-mm port in the right iliac fossa in the anterior axillary line. The right ureter was dissected and mobilized up to the bladder. The diverticulum was dissected, and the dilated ureter was found to be entering the diverticular neck (**Figures 3 and 4**). The ureter was ligated and divided above its insertion. It was brought out through the 10-mm port in the right flank. Tailoring was done, and a 5-F stent was placed. Subsequently the ureter was pushed back into the peritoneal cavity (Transportal tailoring of ureter).⁴ Transverse cystostomy was done superior to the diverticulum starting from the neck of the diverticulum and carried on transversely to match the diverticulotomy (**Figure 5**). The neck of the diverticulum was incised for about half its circumference and the edges were excised. This helped in widening of the diverticulum so that it could be used as a patch for augmenting the bladder. Ureteric reimplantation was done by the intravesical technique by creating a submucosal tunnel in the posterior wall (**Figure 6**). A stent was placed. The diverticular wall was sutured to the line of the cystostomy. Cystoplasty was completed by suturing the diverticulum to the cystostomy margins using 3-0 polyglactin suture (**Figure 7**). Left detrusorrhaphy was done as it was one of the options and further manipulation of the bladder was difficult after the above 2 reconstructive procedures. Detrusorrhaphy was done by dissecting the left lower ureter up to the ureteric hiatus; creating a submucosal tunnel extravasically by dividing a 3-cm length of the detrusor up to the mucosa in the line of the ureter along the posterolateral wall from the ureteric hiatus; placing the ureter in the trough created, and clos-



Figure 1. CT urogram showing the diverticulum with dilated ureter.

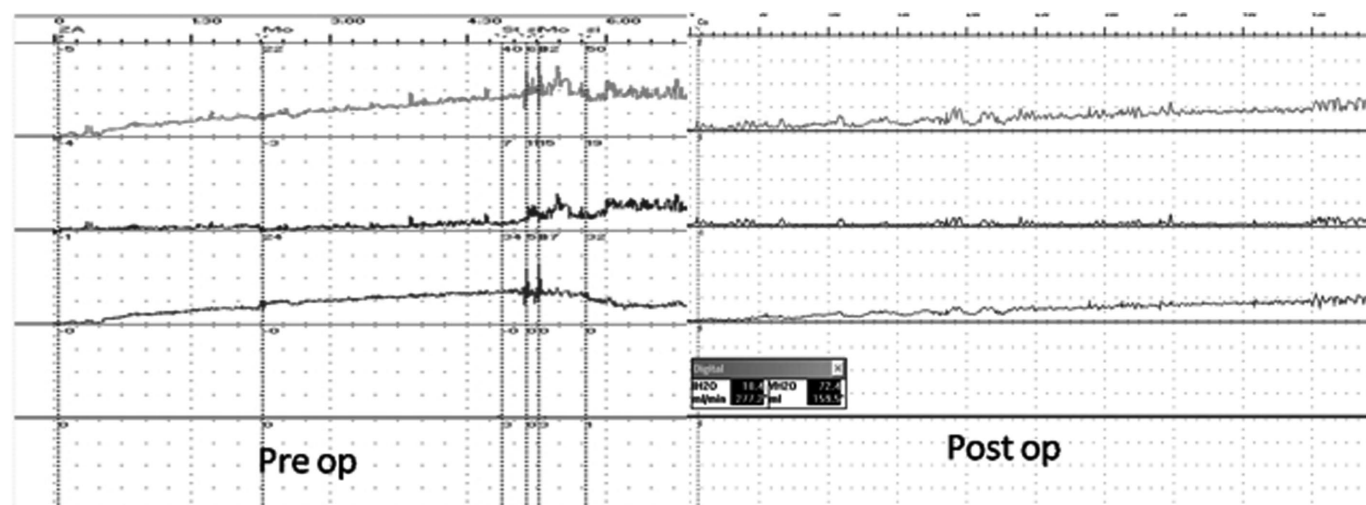


Figure 2. Picture showing preop and postop urodynamic study.

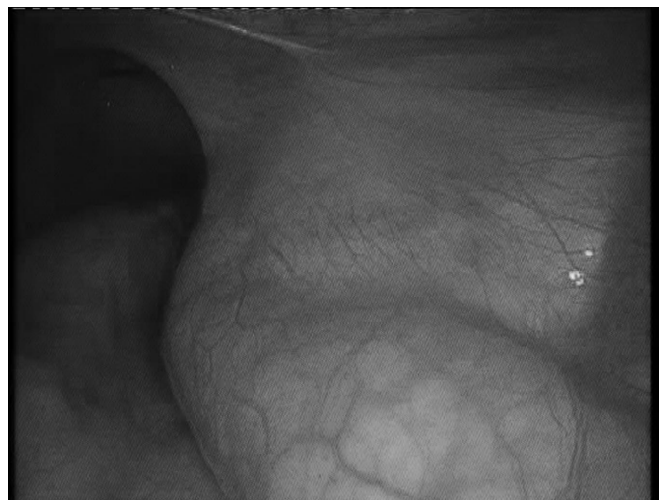


Figure 3. Image showing the dilated ureter.



Figure 5. Cystotomy done.

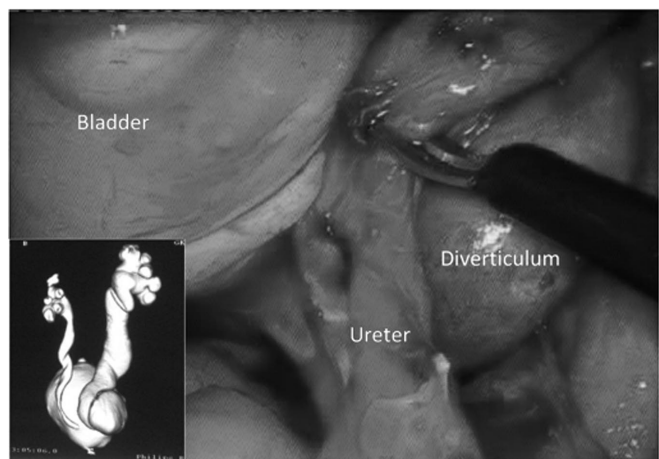


Figure 4. Diverticulum, ureter, and bladder depicted in the image.

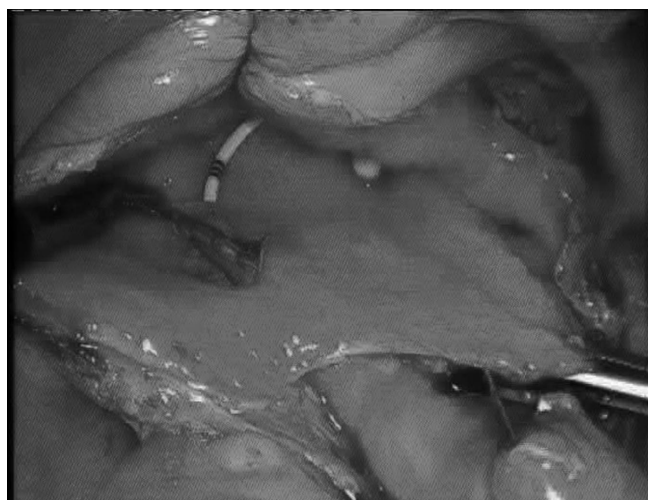


Figure 6. Ureteric reimplantation in progress.

ing the detrusor over the ureter with interrupted sutures thus burying the ureter in the submucosal tunnel. A drain was placed through the right flank port.

The drain was removed on the fourth day, and the child was discharged on the fifth postoperative day. The Foley catheter was removed on the 14th day. The stent was removed after 6 wk. There were no immediate or delayed postoperative complications.

The child has been followed up for more than 1 y. Urodynamic studies were repeated after 3 mo. The compliance improved from 2.8mL/cm H₂O to 6mL/cm H₂O. The capacity improved from 80mL to 130mL. There was no overactivity. Isotope renogram was done following the procedure, which revealed improvement of the GFR to



Figure 7. Completed diverticulocystoplasty.

28.8mL/min from 22mL/min. The GFR of the left kidney improved to 36mL/min from 33.2mL/min. Postprocedure VCUG revealed reduced grade of reflux on the left side (grade 2 from grade 3). The child did not develop any UTI in the postoperative period.

DISCUSSION

The posterior urethral valve can cause a variety of problems to the urinary tract. In this child, the compliance of the bladder was poor, and there was a large diverticulum in the bladder, right obstructive megaureter, and left grade IV vesicoureteric reflux.

In this complex scenario, there are several options of reconstruction to answer all the issues.

The options in this child were:

1. Ileocystoplasty with reimplantation of the right ureter; diverticulectomy with reimplantation of the left ureter.
2. Ureterocystoplasty using the right lower ureter with right to left transureteroureterostomy with diverticulectomy and management of left ureteric reflux later.
3. Diverticulocystoplasty with right ureteric reimplantation with detrusorrhaphy for the left ureter.

The first option of using bowel loop to augment the bladder of a child can cause long-term problems. Following the other option of ureterocystoplasty with transureteroureterostomy, the transureteroureterostomy may compromise the right renal unit due to obstruction, or reflux from the already refluxing left unit. It may rarely compromise the left renal unit also due to obstruction. In this child, because a large diverticulum was present, we con-

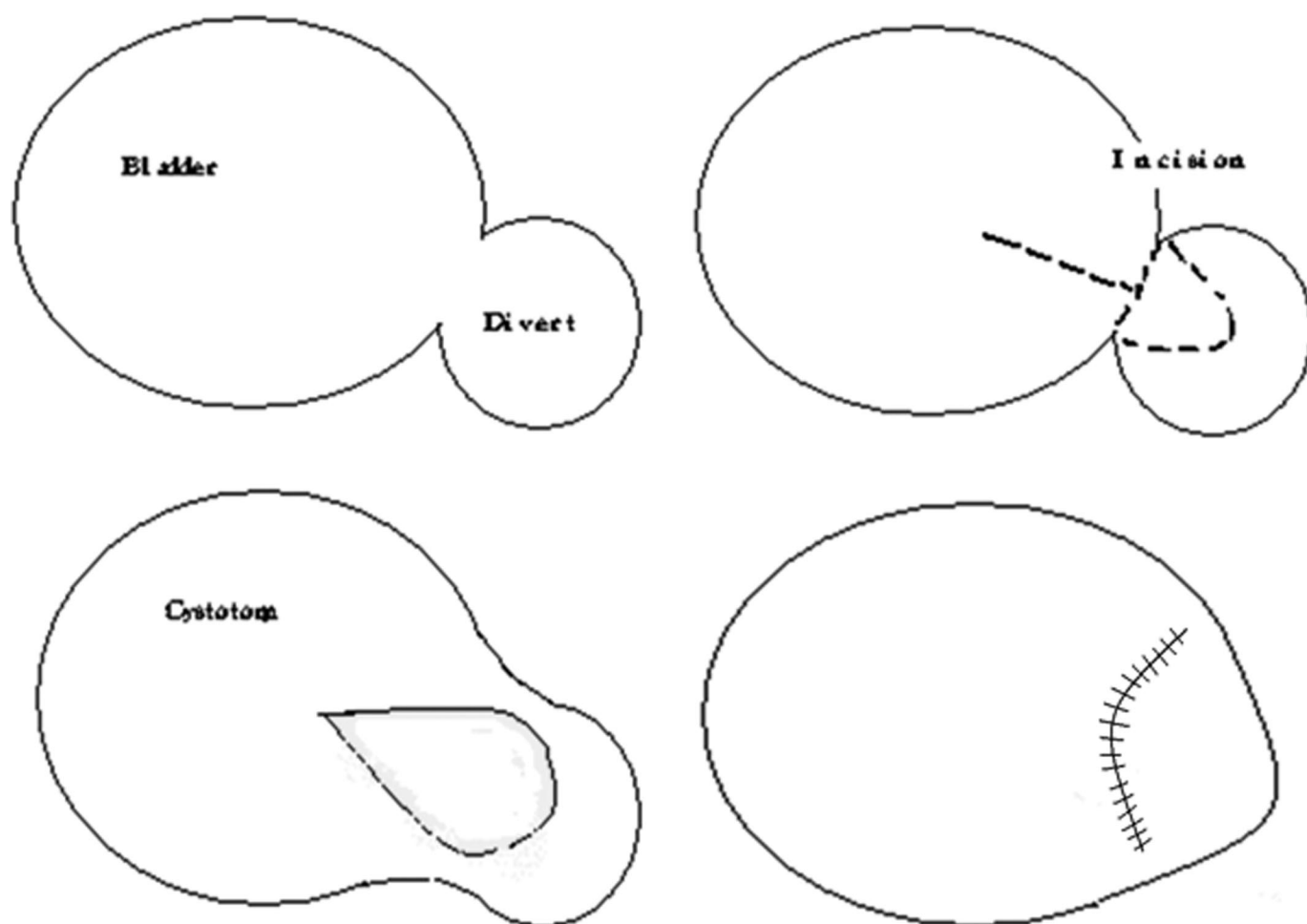


Figure 8. Clip art showing the diverticulocystoplasty.

sidered the third option of using the diverticulum for augmentation.³

The incidence of congenital bladder diverticula in children is 1.7%.⁵ Congenital diverticula are usually single. Though the primary diverticula are characteristically described as arising at the ureterovesical junction, sometimes, secondary diverticula can arise at this site.^{5,6} Low compliance bladder with or without detrusor overactivity due to PUV may be associated with diverticulum (secondary diverticulum). In such cases, the diverticulum represents the pop off mechanism for reducing the bladder pressure.

In this child, the right ureter was obstructed due to primary obstructive megaureter. The left ureter was refluxing. Though the patient had 2 pop-off mechanisms in the operation (diverticulum and refluxing left ureter), he still had low compliance bladder. Hence, diverticulocystoplasty^{3,7} was considered to augment the low-compliance bladder in this child (**Figure 8**). However because the right ureter was entering the neck of the diverticulum, it necessitated ureteric reimplantation.

Management of low-compliance bladder by laparoscopic diverticulocystoplasty has been described in adults.⁸

The present article is the first case report of such a procedure in a child. Postoperative urodynamic study showed improvement in compliance. Renal function on the right side improved, and there was no obstruction on isotope renogram. The histopathology of the diverticulum showed muscle fiber suggesting primary diverticulum. Laparoscopic reconstruction has the benefit of better visualization, cosmesis, and a shorter hospital stay.⁹

CONCLUSION

Laparoscopic diverticulocystoplasty is a feasible option for children with poorly compliant bladder with diverticulum. However, longer follow-up is necessary.

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